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FOREST PEST MANAGEMENT

3430 BIOLOGICAL EVALUATION
R2-84-4

WESTERN SPRUCE BUDWORM
IN THE END O'VALLEY AND HIDDEN VALLEY
CREEK PICNIC AREAS,
ROCKY MOUNTAIN NATIONAL PARK
in
1984

United States
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Forest Service

Forest Pest Management
Denver, Colorado

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WESTERN SPRUCE BUDWORM IN THE END O'VALLEY AND HIDDEN VALLEY CREEK PICNIC AREAS, ROCKY MOUNTAIN NATIONAL PARK in 1984

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INTRODUCTION

The current western spruce budworm outbreak began along the northern Front Range of Colorado in the early 1970's. In 1984, just over 2 million acres of Douglas-fir, white fir and mixed conifer types were defoliated by the insect in Colorado. In 1983, that figure was 2.6 million acres. This is the first decrease in visible defoliation in many years. Most of the top-kill and tree mortality caused by this insect occurs in the Douglas-fir type along the northern Front Range where defoliation has occurred each year since the outbreak began.

In September 1984, in response to a request by Rocky Mountain National Park (RMNP), a biological evaluation was conducted to gather data to predict 1985 budworm population levels at the End O'Valley and Hidden Valley Creek Picnic Areas.

Park administrators were concerned that defoliation by the budworm would accelerate the decline of stands in the picnic areas which would result in decreased landscape values and increased numbers of tree hazard situations. In addition, the budworm larvae were considered a significant nuisance by Park visitors. Therefore spraying was being considered to reduce budworm impacts in the two picnic areas.

EVALUATION METHODS

Egg mass density is used to monitor spruce budworm trends, to evaluate long term effects of control projects and to forecast defoliation. Reliable prediction of the course of an outbreak is the key to deciding for or against control measures. Some outbreaks are curbed by natural factors and others continue to expand and cause widespread damage. Annual defoliation predictions are based on the density of new egg masses on branch samples collected from the midcrown of preferred host trees, i.e., Douglas-fir or white fir.

At the Hidden Valley Creek Picnic Area, no preferred host trees were found. The predominant species in this area was Engelmann spruce which is a non-preferred host of the budworm. At the End O'Valley picnic area some Douglas-fir were found but again the predominant species was Engelmann spruce. Therefore, for consistency, only Engelmann spruce were sampled at each picnic area.

For this evaluation, one 27-inch branch was pruned from the midcrown of each of thirty trees at each picnic area. The foliage samples were bagged, labeled, and transported to the laboratory, where new egg mass densities were determined. A stereoscope was used to separate new from old egg masses.

Egg mass density classes and expected defoliation are displayed in Table 1. These classes are adopted from McKnight, et al. (1970), and were refined by Linnane (1978) based on four years of data.

Estimates of the current year defoliation levels were made from the egg mass sample branches. For each sampling site, the new growth on 25 randomly selected twigs was examined in the laboratory to determine the percentage of defoliation. Defoliation estimates are based on the percent of missing needles determined by an ocular examination of each twig.

Table 1. Defoliation Prediction Classes for Western Spruce Budworm Egg Mass Sampling in the Rocky Mountain Region.

Class	Mean Number of New Egg Masses Per Square Meter Foliage	Defoliation Prediction 1/
1	1.6 or less	Undetectable
2	1.7 to 10.0	Light
3	10.1 or more	Moderate to Heavy

1/ Defoliation expected on new growth of Douglas-fir or white fir only.

Undetectable	0 - 10%
Light	10 - 35%
Moderate	36 - 65%
Heavy	65 - 100%

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RESULTS

The results of the evaluation of the picnic areas are displayed in Table 2. The data indicates that only light defoliation is expected at the picnic areas in 1985. However, defoliation forecasts on Engelmann spruce are questionable because the budworm sampling scheme is based on egg mass density data gathered from Douglas-fir or white fir. To obtain a better idea of budworm population levels near the Park, data from the Roosevelt National Forest are presented in Table 3.

On the Roosevelt National Forest in 1985, light defoliation is expected at Devil's Gulch and Big Elk Meadows. Of all the areas sampled, these two are the closest to the Park. At Magnolia Road, 6 miles west of Boulder, moderate to heavy defoliation is expected in 1985.

Table 2. Results of Western Spruce Budworm Egg Mass and Defoliation Survey at Rocky Mountain National Park in 1984.

Area	Number of Branch Samples	1984 Defoliation Estimate	Mean Number of New Egg Masses per Square Meter Foliage	1985 ¶/ Defoliation Prediction
End O'Valley Picnic Area	30	Moderate (49.6%)	5.2	Light
Hidden Valley Creek Picnic Area	30	Moderate (53.4%)	8.9	Light
Summary	60	Moderate (51.5%)	7.1	Light

¶/ The defoliation prediction is somewhat debatable because it is based on what would be expected if the corresponding egg mass density existed on Douglas-fir or white fir. At these two picnic areas, only Engelmann spruce was sampled.

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Table 3. Western Spruce Budworm Egg Mass Densities at the Roosevelt National Forest, 1983 and 1984.

Area	Mean Number of New Egg Masses per Square Meter Foliage 1983	Defoliation 1984	Mean Number of New Egg Masses per Square Meter Foliage 1984	Predicted †/ Defoliation 1985
Devil's Gulch	2.5	38.4%	7.0	Light (10-35%)
Big Elk Meadows	11.4	48.3%	9.6	Light (10-35%)
Magnolia Road	16.5	58.8%	17.6	Mod.-Hvy. (36-100%)
Summary	10.1	48.5%	11.4	

†/ Only Douglas-fir was sampled on the Roosevelt National Forest.

ALTERNATIVES

Direct Suppression with Aerial Application of Insecticides

An Environmental Assessment (EA) of the western spruce budworm outbreak in the Rocky Mountain Region was prepared in 1982 (USDA Forest Service, 1982). This alternative was considered in the EA. The Decision Notice of that document explained that the Aerial Application of Insecticides Alternative was not adopted because of concerns over effectiveness in suppressing the budworm by the aerial application of insecticides, the high cost of this alternative, and public opinion of aerial insecticide spraying.

Direct Suppression with Ground Application of Bacillus thuringiensis (Bt)

Excellent access to each of the picnic areas would allow the treatment of those areas by the truck-mounted hydraulic sprayer. The cost of a ground application could be significantly less than the cost of an aerial application and the spray coverage would be significantly better.

Bt is a naturally occurring bacterium. It is a specific insecticide having no demonstratable effect on non-target organisms. It is often used against the budworm in evironmentally sensitive areas including areas immediately adjacent to lakes and streams.

Direct Suppression with Ground Application of Chemical Insecticides

Of the several chemical insecticides registered for use against the western spruce budworm, two are recommended by Forest Pest Management. They are carbaryl and acephate. Their effect on non-target organisms, particularly aquatic insects, would necessitate the use of mitigating measures to prevent the direct application of these chemicals to water.

MAINTAIN CURRENT MANAGEMENT

This is the no action alternative. This alternative would allow the spruce budworm epidemic to run its course. The budworm populations will eventually collapse as a result of natural factors. Historically these epidemics have lasted 12 to 15 years. The current outbreak in Rocky Mountain National Park began about 11 years ago, but how long epidemic populations have existed in these two specific areas is speculative.

Continued defoliation of trees in the picnic areas could result in further stress and permanent tree injury which would result in reduced landscape values and an increase in the number tree hazards.

RECOMMENDATIONS

Forest Pest Management recommends the Direct Suppression with Ground Application of Chemical Insecticides alternative for the following reasons:

1. Since the areas of concern are sites subject to abnormal soil compaction, we would expect that the useful life of these picnic grounds may be shortened further as a result of budowrm induced damage.

   Continued defoliation of trees in the picnic areas could result in tree top-kill and mortality. This top-kill and mortality would result in decreased landscape values and an increase in the number of tree hazards.

2. Chemical insecticides are recommended because while Bt is a safe insecticide that would produce a significant reduction in the budworm population, the use of Bt in this situation would have some shortcomings:

   a. The results of several suppression projects show that the efficacy of Bt in budworm population reduction is erratic and generally less than the efficacy of the recommended chemical insecticides.

   b. It has also been demonstrated that Bt usually provides less foliage protection than the chemical insecticides do.

   c. Larvae will remain alive on the foliage for up to fourteen days after being sprayed with Bt while chemical insecticides will provide relatively quick knockdown.

Both of the recommended chemicals (carbaryl and acephate) are relatively broad-spectrum insecticides that may impact non-target insect species, particularly aquatic insects. Therefore, mitigating measures must be taken to prevent the direct application of these chemicals to water. Possible mitigation measures are:

1. Establish buffer zones where no spraying will take place. Buffer zones will include areas adjacent to streams, creeks, lakes, and non-participating ownerships.

2. Spray only in calm wind conditions (wind velocity <5 mph).

3. Consider placing plastic under trees which may be overhanging streams.

Good timing for spray application is critical. Spraying must be done when the larvae are exposed and feeding actively. Efficacy of the spray application is generally best when ninety percent of the larvae are fourth

and fifth instars. Because of this timing, some defoliation will still occur in the spray area. It has been shown in some cases that only thirty percent of the expected defoliation is prevented.

Reinfestation of the sprayed area should be expected since the picnic areas will be surrounded by vast untreated areas which support high budworm populations. This may necessitate annual retreatments of the picnic areas in order to have a long-term reduction in damage.

Post-treatment evaluations should be made to measure the benefits of the spraying.

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